Nutten Hook Shoreline Stabilization Assessment
Town of Stuyvesant, NY

June 16, 2015

Prepared for:
Hudson River National Estuarine Research Reserve
NYS Department of Environmental Conservation
259 Norrie Point Way
Staatsburg, NY 12580

Submitted by:
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Executive Summary

The NYS Department of Environmental Conversation’s Hudson River National Estuarine Research Reserve has requested BlueShore Engineering LLC assess an eroding shoreline at the Nutten Hook site in Stuyvesant, NY to determine appropriate shoreline stabilization measures in order to preserve public access to the site for recreational purposes.

On Monday, May 11, 2015, Richard W. Gilbert, P.E. of BlueShore Engineering LLC and Sven Hoeger, Ecologist of Creative Habitat Corporation visited the site to observe and assess existing site conditions. Existing shoreline protection structures that were observed include a timber bulkhead along the western shoreline and a stacked rock seawall along the southern shoreline. The bulkhead appears deteriorated and only offers shoreline protection at water levels below Mean High Water, while the seawall appears in good condition toward its eastern end, but has been undermined by tree roots that are breaking apart the seawall’s stone composition toward its western end. Most of the erosion at the site has occurred along the southwestern, western, and northwestern extents of the shoreline.

For short-term planning purposes, thorough surveying of current site conditions will be necessary for the design of shoreline stabilization methods and to ensure the legal right to permit the site’s repair and/or maintenance in the future. Recommended surveying includes the following: a topographic survey of the site and its features, a hydrographic survey of the surrounding Hudson River area, the collection of soil borings, and further investigation regarding the historic value of the existing seawall.

Given the high-energy wave action at the site, recommended shoreline stabilization design strategies utilize a combination of vegetation, soil and rock fill and breakwater structure approaches. Along the western shoreline, the bulkhead should be maintained in order to provide shoreline protection below Mean High Water and vegetation/rock fill should be added along the adjacent bank to provide shoreline protection above Mean High Water. Along the southwestern shoreline, the seawall should be maintained using rock/soil fill and added shrubbery (as opposed to trees) to enhance the seawall’s stability and longevity. Given the good condition of the eastern end of the seawall, additional shoreline protection measures along the southeastern shoreline are not recommended at this time. Additionally, as the northeastern shoreline area has little to no evidence of active erosion, additional shoreline protection measures along the northeastern shoreline are not recommended at this time.

Along the northwestern shoreline where the shoreline is entirely exposed, the addition of a breakwater structure should be considered (possibly through the extension of the existing bulkhead toward the north) along with the use of vegetation along the bank to assist with shoreline stabilization. For long-term planning purposes, bulkhead replacement will need to occur with consideration given to repairing the western end of the seawall.

The proposed shoreline improvement and stabilization project will require the submission of permit packages for the following:

1) Protection of Waters Permit and Freshwater Wetlands Permit as well as 401 Water Quality Certification for additional in-water structures, from the NYS Department of Environmental Conservation;
2) Coastal Management Program consistency review, through the NYS Department of State; and
3) US Army Corps of Engineers Permit, under Section 10 of the Rivers and Harbors Act for work seaward of the Mean High Tide line and Section 404 of the Clean Water Act for additional in-water structures.

Introduction

Nutten Hook in the town of Stuyvesant, NY is located on the eastern shoreline of the north Hudson River. The site of concern in this assessment is located at the western-most foot of Ferry Road (see Figure 1). The NYS Department of Environmental Conversation’s Hudson River National Estuarine Research Reserve (HRNERR) has requested BlueShore Engineering LLC (BlueShore) assess the referenced site to determine appropriate shoreline stabilization methods to preserve the community’s access to the river for fishing and river-viewing.

This document was prepared to outline the process necessary to design and implement shoreline improvements in order to maintain public access to the site. An initial site visit was performed to observe and assess existing conditions. Shoreline stabilization and improvement strategies were then discussed with regulatory representatives from the NYS Department of Environmental Conservation (NYSDEC) and the US Army Corps of Engineers (USACE). This report summarizes our conceptual recommendations for stabilizing the shoreline as well as regulatory implications and technical concerns regarding the short-term and long-term planning processes.

Figure 1. Nutten Hook vicinity plan (see attachment R-1.0)

Project priorities involve the development of shoreline stabilization methods that protect the continued usage of the Nutten Hook park by fisherman and the general public alike, with particular emphasis on
protecting the road that provides access to the site. Ideal shoreline stabilization methods will focus on an optimized combination of effective, sustainable and low-cost solutions, with vegetative stabilization approaches preferred. Stabilization methods discussed herein assume that trailers will not be allowed access into the site and that the launching of boats from the ad hoc ramps that have formed on-site (due to past trampling over the “ramp” areas from boat trailers) will not be permitted.

**Site Description**

The Nutten Hook site being discussed herein is located at the western foot of Ferry Road in Stuyvesant, NY. The site once supported ferry operations between Stuyvesant and Coxsackie, NY and presently offers public utility for river-viewing, fishing and other passive recreational activities. An informal parking lot is located on site to encourage public use.

The adjacent Hudson River is a US navigable waterway, which means that the USACE regularly surveys the riverbed and dredges if necessary to maintain the navigational channel. The most recent publicly accessible navigational chart for the area from the US Department of Commerce’s National Oceanic and Atmospheric Administration (NOAA), which was last updated on May 27, 2015, shows that the majority of the site’s surrounding waterway (at an approximate distance of 40 feet from the Nutten Hook site shoreline) has an average mudline depth of 32 feet below Mean Lower Low Water (MLLW). The channel depth data was a result of the most recent channel survey conducted in February 2015 (see Figures 2 and 3). The State of New York has high resolution benthic mapping data available for further analysis.

![Figure 2. Section of navigational chart from the NOAA, covering Coxsackie to Troy, NY](image)
The site is located in an A-Zone Special Flood Hazard Area (SFHA) according to the most recent FEMA Flood Insurance Rate Map (FIRM) #361323-0002-B for the area, dated September 14, 1979 (see Figure 4). Flood elevations and flood hazard factors are not determined for this zone on the map.
The closest NOAA National Ocean Services stations to the Nutten Hook site are Station #8518995 in Albany, NY (approximately 20 miles north of Stuyvesant, NY) and Station #8518951 in Hyde Park, NY (approximately 45 miles south of Stuyvesant, NY). Interpolating tide/water level data from these two stations results in the development of an approximate datum chart for the Nutten Hook site, as shown in Table 1 below.

<table>
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<th>Datum Conversion Table (feet)</th>
<th>MLW</th>
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Table 1. Datum conversion table

Site Observations

On Monday, May 11, 2015, Richard W. Gilbert, P.E. of BlueShore Engineering LLC and Sven Hoeger, Ecologist of Creative Habitat Corporation visited the site to observe and assess existing site conditions. Also in attendance were representatives from the NYSDEC, including Ann-Marie Caprioli, Trish Gabriel, Peter Innes, and Daniel Miller, as well as representatives from the USACE, including Brad Sherwood.

Noteworthy features at the site include a timber bulkhead running north-to-south along the site’s western-most shoreline, a stacked rock seawall running east-to-west along the site’s southern-most shoreline and the northeastern extent of the Nutten Hook site shoreline (see Figure 5). The bulkhead, seawall, and northeastern shoreline constitute the three areas of significance that are thoroughly analyzed and discussed in this report.

The site’s shoreline has experienced a lot of scarping and erosion in many areas due to high-energy wave action. Many of the large cottonwood trees toward the northwest of the shoreline are on the brink of teetering due to significant erosive damage. The existing bulkhead appears to offer some assistance with regards to protecting the shoreline from wave action below Mean High Water (MHW). However, as the bulkhead appears deteriorated and does not reach adequate heights (at or above MHW) to successfully offer complete shoreline protection, the parking area located at the foot of Ferry Road and the access road itself are at risk of being lost to continued erosion.

There currently exists a stacked rock seawall along the south-facing shoreline that appears to be in relatively good condition toward the eastern end, but appears to be at high-risk for washing out toward the western end. The large amount of trees growing directly adjacent to the seawall’s western end aid in advancing the seawall’s degeneration given that the roots slowly fragmentize the seawall and undermine its structural integrity.
There are three specific areas along the site’s shoreline where significant erosion has occurred (see Figure 5). At two of these locations, toward the northern and southern ends of the western shoreline, several trees have exposed roots from erosion and are at risk of falling into the river. At one of these locations, toward the western end of the southern shoreline, erosion has developed primarily from the past use of the area as an ad hoc trailer boat launch; precast concrete blocks were placed at the top of the slope to prevent its use as a boat launch and thereby prevent further erosion at the shoreline. It was observed that the precast concrete blocks have been slowly sliding downward toward the Hudson River due to wave action, as tombolo formations are prevalent around the blocks.

It should be noted that the railroad crossing at Ferry Road (near the Ferry Road and Route 9J intersection) is inadequate for use by trailered boats. Therefore, shoreline stabilization plans discussed herein assume that trailers will not cross the railroad tracks to get into the site and that boat ramp access will not be permitted.
Short-Term Planning

The following section outlines the process that will be required to implement short-term shoreline improvements likely within the next one to two years at Nutten Hook.

Conceptual recommendations discussed herein were prepared after the review of relevant literature by the NYS Department of Environmental Conservation’s HRNERR, including the following:


The 2006 publication singles out the following “natural” shoreline stabilization methods as potentially applicable along the Hudson River Shores: Vegetated geogrid, live cribwall, joint planting, brush mattress, vegetated rock gabion, and vegetated rock gabion mattress. The 2012 publication reviews existing shoreline treatments and discusses the costs, technical limits, advantages and disadvantages of each technique; from this publication, the following additional treatments appear potentially useful for the Nutten Hook site given their ability to reduce the intensity of wave action: Bulkheads, wave screens, floating breakwater structures, other breakwater structures, and sills.

Surveying

A thorough investigation involving site surveying is necessary for the design of shoreline stabilization methods. It is also important to conduct a survey to develop records of the site’s existing location, position and condition to ensure the legal right to permit the site’s repair and/or maintenance in the future. If there exists a well-defined record of the site’s condition as it presently exists, then future permitting endeavors will be easier to navigate through.

Surveying that will be required includes a topographic survey of the site and its features as well as a hydrographic survey of the surrounding Hudson River area. Soil borings are recommended to collect information about the site’s subsurface soil conditions, characteristics and composition. Additionally, further investigation on the historic value of the stacked rock seawall is recommended.

Recommended Design Strategies

Potential shoreline stabilization methods discussed herein were considered based on their ability to stabilize the shoreline as well as maintain and improve the site’s surrounding habitat functions with as little unsustainable impact to the site as possible. Due to the high-energy wave action from the adjacent wetlands, vegetation cannot be relied upon alone to provide the same type of shoreline protection as that of a fully-functional bulkhead or seawall. Therefore, recommended shoreline stabilization design strategies will include a combination of vegetation, soil and rock fill and breakwater structure methods.
I. Western Extent of Shoreline: Timber Bulkhead

At the time of our site visit, the timber bulkhead was entirely submerged under water. On April 18, 2015, BlueShore received photographs from the site that show the top of the bulkhead extended to an elevation above the waterline at the time said photographs were taken. The exact height of the bulkhead is unknown; as previously discussed, a topographic survey will be required to determine the height of the bulkhead. However, it is known that twice a day at particularly high tide, waves breach the top of the existing bulkhead structure, causing erosion and scarping along the site’s shoreline. Given this knowledge, it can be concluded that the bulkhead presently maintains a reasonable slope from the mudline to the adjacent channel and protects the slope along the bank from steepening and failing. However, the bulkhead does not reach adequate heights to protect the shoreline from scarping due to wave action (see Figure 6).

Therefore, it is recommended that the bulkhead be maintained in its current condition to offer shoreline protection value at elevations below MHW, while incorporating rock and vegetation (including shrub or tree plant species) fill along the outer edge of the shoreline (between the bulkhead and the eroding bank) to stabilize the shoreline and offer protection from wave action above MHW (see Figure 6). Plants will need to be chosen based on the ability of their roots to remain anchored and retain soil fines.

Figure 6. Existing bulkhead cross section with potential modifications, not to scale
In the future, when the timber bulkhead has significantly deteriorated and is in the process of failing, more significant measures (such as the restoration or replacement of the bulkhead) can then be taken to protect the slope and shoreline.

II. **Southern Extent of Shoreline: Stacked Rock Seawall**

Modifications to the shoreline along the eastern end of the existing stacked rock seawall will not be required, as the eastern-end of the structure is reasonably coherent at present. However, shoreline stabilization methods will need to be used along the western end of the seawall to prevent further erosion of the structure and to offer structural stabilization of the structure as well. It is recommended that the current seawall line is maintained using only vegetative, stone and soil fill above MHW to sufficiently protect the shoreline from wave action at elevations above MHW (see Figure 7).

![Figure 7. Existing seawall cross section with potential short-term modifications, not to scale](image)

The planting of brush along the western end of the seawall will improve seawall conditions. The observed signs of erosion above the western end of the seawall caution the use of trees for vegetated treatment.
over such a structure. Maintenance that would remove trees and replace them with shrubs, such as dogwoods and shrub willows, would enhance the stability of the existing seawall and presumably increase its life expectancy. Stone can be placed along the seawall’s outer edge as needed in order to maintain the structure. Additionally, fill can be placed along the seawall’s edge in order to repair soil loss, as some washout will likely continue to occur since there is no existing geotextile to prevent the fine-grained sediments from washing out.

As previously discussed, a topographical profile of the existing seawall will need to be developed in order to record its present position and perform future seawall maintenance as needed. Consideration should be given to extending the western end of the seawall if necessary and adding a concrete cut-off wall (see Figure 7) or filter fabric behind the existing seawall to prevent soil washout. While a cut-off wall will be relatively inexpensive and easy to build, plantings are not likely to develop on top of the concrete wall itself, as the concrete may inhibit plants roots from fully establishing. Given the filter fabric option, temporary biodegradable soil filters, for example, can be used to prevent washout during vegetation establishment.

III. Northeastern Extent of Shoreline

The northeastern shoreline edge of Nutten Hook does not need additional shoreline protection measures at this time as the shoreline in this area has little to no evidence of active erosion. Shoreline stabilization and improvement measures along this portion of the shoreline should be discussed if/when erosion in this area is observed.

IV. Northwestern Extent of Shoreline

Along the northwestern extent of the shoreline, near where the large cottonwood trees are being undermined from erosion, a type of breakwater structure along with vegetative fill will likely need to be added to protect this part of the shoreline. Consideration may be given toward extending the existing bulkhead further north to protect this northwestern extent of the shoreline.

Though the end goal is to include a stationary breakwater at this extent, a temporary floating breakwater (i.e. box, pontoon, mat or tethered breakwaters) can be installed as an extension of the existing timber bulkhead until a more permanent solution is derived. This temporary breakwater will act as part of a study to determine what kinds of plants are capable of developing in the environment and more importantly, holding the bank sediments together to resist erosion. Proprietary examples of floating breakwater structures include WhisprWave, Wavebrake, and WaveEater. Test-planting should occur during ice-free periods, as icy conditions could cause damage to the temporary floating breakwater structure.

V. Additional Considerations

As previously stated, to further evaluate the feasibility of shoreline stabilization with the aid of vegetation, a temporary floating breakwater structure can be installed as an extension of the existing bulkhead to see how the plantings would fare. The temporary breakwater can also be studied at various locations along the shoreline to better determine what kind of plants might be best for certain locations.
A seasonal floating breakwater option might involve the construction of a floating gangway and heavy dock that can provide mitigation of wave action while simultaneously serving to extend the fishing area or even create a kayak launching area. It should be emphasized again that all floating breakwater structures will need to be removed in the winter, as icy conditions can cause damage to the structures.

Project planning should also consider the installation of designated paths for fisherman, which can be achieved through the addition of a floating dock and gangway for recreational purposes, as part of the site’s shoreline improvements.

**Long Term Planning**

The following section outlines the process that will be required to implement long-term shoreline improvements likely after three years at Nutten Hook.

**Surveying**

As previously stated, surveying is necessary to develop record details of the site’s existing positions such that there exists a legal right to ensure the site continues to operate at serviceable conditions through means of future repairs and maintenance activities. Surveying is more of a crucial factor in the short-term planning process than in the long-term planning process. However, with regards to long-term planning, surveying is necessary to develop strategic design details for shoreline repair and/or maintenance efforts.

**Recommended Design Strategies**

At present, the existing timber bulkhead assists with providing shoreline stabilization below the MHW line. As the timber bulkhead is slowly undergoing a natural deterioration process, it will need to be replaced at some unknown time in the future. Replacement options might include a refurbished or modified bulkhead in its place in order to restore its intended function and aid in allowing for increased natural recruitment of the site’s herbaceous vegetation. Should bulkhead replacement occur, consideration should be given toward extending the bulkhead to offer complete protection along the site’s western shoreline as well as raising the bulkhead height at or above MHW to offer complete shoreline protection from wave action.

A breakwater function can also be achieved through the use of a wave screen or the seasonal use of a floating breakwater that would have to be removed during the winter, when icy conditions could cause damage to the structure. A wave screen might be a preferred breakwater alternative since it has a smaller impact on aquatic life, as it allows for passage through the screen at elevations further below Mean Low Water.

Furthermore, consideration might be given toward repairing and/or extending the western end of the existing stacked rock seawall, should maintenance through the continued placement of fill become an exorbitant task. Near-shore survey soundings could reveal stretches of shoreline that could benefit from an underwater solid stone toe, sill or breakwater to protect portions of the shoreline (see Figure 8). The hard toe approach will prevent scour at the toe and can be varied through the utilization of vegetated geogrids or joint plantings in stone revetment.
Permitting Implications

The proposed shoreline stabilization measures along the eastern shore of the Hudson River will have environmental permitting implications with the US Army Corps of Engineers (USACE), the NYS Department of Environmental Conservation (NYS DEC) and the NYS Coastal Management Program consistency review through the NYS Department of State (NYSDOS).

US Army Corps of Engineers

For short-term planning, if vegetative fill is to extend seaward of the Mean High Tide line, a USACE permit will be required under Section 10 of the Rivers and Harbors Act, which covers all structures and work within a US navigable waterway, extending over a boundary defined from the Mean High Tide line up to three geographical miles seaward of the Ordinary Low Tide line. Short-term project activity may fall within Nationwide Permit #13 for bank stabilization and Nationwide Permit #27 for aquatic habitat restoration, establishment and enhancement.

Figure 8. Existing seawall cross section with potential long-term modifications, not to scale
For long-term planning, a USACE permit will be required under Section 10 of the Rivers and Harbors Act given bulkhead/seawall repair or maintenance activities and under Section 404 of the Clean Water Act given the new construction and/or extension of the bulkhead/seawall. Long-term maintenance and repair project activity may fall within Nationwide Permit #3 for maintenance, depending on the extent of work.

**NYS Department of Environmental Conservation**

For both short-term and long-term planning, as the shoreline improvement project will involve the disturbance to bed or banks of a river and/or the placement of fill below the MHW level of navigable waters of the state, a Protection of Waters Permit with the NYSDEC will be required under Title 5 of Article 15 of the Environmental Conservation Law (ECL). Additionally, a Freshwater Wetlands Permit with the NYSDEC will be required under Article 24 of the ECL.

For long-term planning, the addition of in-water structures will require a 401 Water Quality Certification from the NYSDEC.

**NYS Department of State**

The shoreline stabilization/improvement project must also be reviewed for consistency with the NYSDOS’s Coastal Management Program (CMP) to ensure the project meets the state’s standards regarding the protection of the its coastal resources.

BlueShore has reviewed the proposed project under NYS CMP policies and have found that the project generally either promotes or does not affect the majority of the listed policies. The project will revitalize an underutilized waterfront, facilitate water dependent uses, expand public access and water-related recreation, redevelop the existing built environment, minimize damage to property, natural resources, and the endangering of human lives caused by erosion, prefer non-structural measures to minimize damages from erosion, and protect and enhance resources that contribute to the overall scenic quality of the coastal area.

According to Policy #13, “the construction or reconstruction of erosion protection structures shall be undertaken only if they have reasonable probability of controlling erosion for at least thirty years.” 30-year erosion control will need to be demonstrated in design and construction standards and in assured maintenance or replacement plans.

**Conclusion**

The proposed shoreline improvement and stabilization project will require the submission of permit packages for the following:

1) Protection of Waters Permit and Freshwater Wetlands Permit as well as 401 Water Quality Certification for additional in-water structures, from the NYS Department of Environmental Conservation;
2) Coastal Management Program consistency review, through the NYS Department of State; and
3) US Army Corps of Engineers Permit, under Section 10 of the Rivers and Harbors Act for work seaward of the Mean High Tide line and Section 404 of the Clean Water Act for additional in-water structures.

As habitat enhancement is generally encouraged, there will likely not be any short-term impediments toward obtaining permits with USACE and NYSDEC as long as vegetative fill into the waterway is not excessive. As the repair and maintenance of coastal areas is generally encouraged, there will likely not be any long-term impediments toward obtaining permits with the USACE and NYSDEC as long as bulkhead/seawall repairs will not affect the surrounding area more so than the existing bulkhead and seawall. As the project generally either promotes or does not affect the majority of the NYS CMP policies, there will likely not be any short-term or long-term impediments toward obtaining a favorable consistency review.

**Conclusion**

Vegetation, soil and rock fill will improve the value of Nutten Hook’s shoreline by offering shoreline stabilization at and above MHW, while existing breakwater structures offer shoreline protection below MHW. Therefore, it is recommended that short-term planning consider a combined shoreline stabilization approach using vegetation, soil and rock fill with existing breakwater structures.

Along the site’s southern shoreline, the use of rock/soil fill and shrubbery (with roots that will bind together fine sediments along the bank) combined with a well-maintained existing seawall is recommended. Along the site’s western shoreline, the use of vegetation and rock fill combined with a well-maintained existing bulkhead is recommended. Along the site’s northwestern shoreline where the bulkhead does not extend, consideration should be given toward including an additional breakwater structure mixed with a vegetation approach to offer sufficient shoreline protection. Along the site’s northeastern shoreline, no additional shoreline protection measures are recommended at this time.

Long-term planning may include the replacement of the existing timber bulkhead as well as the repair of the western end of the existing seawall, with consideration given to the extension of the bulkhead to the north and the extension of the seawall to the west. Surveys taken now will record and demonstrate the existing conditions of on-site serviceable structures to be maintained in the long-term.
Photographs

Photo 1. Herbaceous vegetation on the partially protected shoreline (partially protected by the existing timber bulkhead). The shore is frequently used by fisherman.

Photo 2. The existing timber bulkhead, with herbaceous vegetation (including various grasses and American bulrush) stabilizing fine-grained sediments.
Photo 3. Example of exposed shoreline, where standing trees are getting undermined as a result of high-energy wave action generated by wind and boat wakes.

Photo 4. Trees and shrubs growing on top of an established stacked rock seawall are showing signs of erosion in the root zone toward the western end, indicating high-energy input.
Photo 5. Toward the eastern end of the stacked rock seawall, the structure still remains in good condition.

Photo 6. Precast concrete blocks placed across one “ramp” formation to prevent the use of this area as an ad hoc trailer boat launch.
Photo 7. Example of erosion along shoreline, where the informal parking lot is being lost as a result of high-energy input generated by wind and boat wakes.

Photo 8. Example of an area of erosion along the site’s shoreline.
Photo 9. Parking lot at the foot of Ferry Road and its proximity to the adjacent Hudson River.

Photo 10. Northeastern extent of shoreline, where additional shoreline protection measures are not necessary at this time.
Project Number: 150215
Datum: NAVD88
USGS Quad: Hudson North
Waterway: Hudson River
Latitude: 42° 21' 14.89" N
Longitude: 73° 47' 19.10" W